Claims

1. Apparatus for electroplating a workpiece, comprising:

an anode, and a cathode for supporting the workpiece, wherein the anode and cathode are immersed in a solution, for generating an electric field emanating from the anode towards the cathode, to generate a corresponding current to deposit an electroplating material on the workpiece during an electroplating process; and

a selective anode shield/material flow assembly located between the anode and the cathode, and forming a multitude of adjustable openings, the openings having sizes that are adjustable during the electroplating process for selectively and controllably adjusting the amount of electric flux passing through the shield/material flow assembly and the distribution of the electroplating material across the workpiece.

2. Apparatus according to Claim 1, further comprising a control connected to the selective shield/material flow assembly for adjusting the sizes of the openings of the shield/material flow assembly during the electroplating process.

3. Apparatus according to Claim 1 wherein said selective shield/material flow assembly includes at least one

selective shield material flow mechanism forming a first series of openings.

4. Apparatus according to Claim 1, wherein:

the selective shield/material flow assembly includes

a first shield/material flow mechanism forming a first series of openings, and

a second shield/material flow mechanism forming a second series of openings; and

the first and second series of openings form the adjustable openings of the selective shield/material flow assembly.

5. Apparatus according to Claim 4, further including: means connecting the first and second selective shield material flow mechanisms together for movement relative to each other, and wherein said first and second selective shield material flow mechanisms are moved relative to each other to change the sizes and locations of the adjustable openings of the selective shield material flow mechanism.

6. Apparatus according to Claim 4, wherein said movement relative to each other is rotational movement.

7. Apparatus according to Claim 4, wherein:

the first selective shield/material flow mechanism includes

a first support member, and

a first set of slats supported by the first support member, and positioned so as to form the first series of openings; and

the second selective shield/material flow mechanism includes

a second support member, and

a second set of slats supported by the second support member, and positioned so as to form the second series of openings.

8. Apparatus according to Claim 7, wherein the means connecting the first and second selective shield/material flow mechanisms together include a series of links connecting the first and second support members together for limited transverse movement relative to each other.

9. Apparatus according to Claim 1, further comprising a support supporting the selective shield/material flow mechanisms for movement toward and away from at least one of the anode and the cathode.

10. Apparatus according to Claim 9, wherein the support supports the selective shield/material flow mechanism for movement along three mutually orthogonal axes, relative to both the anode and the cathode.

11. A method of electroplating a workpiece, comprising the steps:

immersing an anode and a cathode in a solution;

using the cathode to support the workpiece;

positioning a selective shield/material flow assembly between the anode and the cathode, said shield/material flow assembly forming a multitude of openings having adjustable sizes;

generating an electric field emanating from the anode to the cathode, to generate a corresponding current to deposit an electroplating material on the workpiece during an electroplating process;

adjusting the sizes of the adjustable openings, during the electroplating process, for selectively and controllably adjusting the amount of electric flux passing through the selective shield/material flow assembly and the distribution of the electroplating material across the workpiece.

12. A method according to Claim 11, wherein the selective shield/material flow assembly includes first and second selective shield/material flow mechanisms, and the adjusting step includes the step of moving the first and second selective shield/material flow mechanisms relative to each other to adjust the sizes of the opening of the selective shield/material flow assembly.

13. A method according to Claim 12, wherein the step of moving the first and second selective shield/material flow mechanisms also adjusts the location of the opening of the selective shield/material flow shield assembly.

14. A method according to Claim 12, wherein the first selective shield/material flow mechanism includes a first series of through openings, and the second selective shield/material flow mechanism includes a second series of through openings, and wherein:

the adjusting step further includes the step of using the first and scend series of openings, in combination, to form the openings of the selective shield/material flow assembly; and

the moving step includes the step of moving the first and second selective shield/material flow mechanisms laterally relative to each other to adjust the sizes of the openings of the selective shield/material flow assembly.

15. A method according to Claim 12, wherein the positioning step includes the step of connecting the first and second selective shield/material flow mechanisms together for limited movement relative to each other.

16. A method according to Claim 15, wherein:

the positioning step includes the further step of providing a control means to move the selective shield/material flow mechanisms relative to each other; and

the adjusting step includes the step of using the control means to move the selective shield/material flow mechanisms relative to each other during the electroplating/electroless process to adjust the sizes of the openings of the shield/material flow apparatus mechanism.

17. Apparatus for electroless plating comprising:

a work piece;

a fixture supporting said work piece, wherein said fixture supporting said work piece is immersed in an electroless plating solution, for generating an electric potential emanating from said electroless plating

solution towards said work piece for depositing material on said work piece;

a electroless plating flow source;

a selective shield/material flow assembly located between said electroless plating solution source and said fixture supporting said work piece, and forming a multitude of adjustable openings, said openings having sizes that are adjustable for selectively and controllable adjusting the amount of electroless solution passing through said selective shield/material flow assembly and the distribution of depositing material on said work piece.

18. Apparatus for depositing material on a work piece comprising:

a source of depositing material;

a transport medium;

a work piece holder;

at least one work piece supported in said work piece holder and immersed in said transport medium;

a selective shield/material flow assembly also immersed in said transport medium, located between said source of depositing material and said work piece holder, said

selective shield/material flow assembly forming at least one adjustable opening, said at least one adjustable opening having a size that is adjustable for selectively and controllable adjusting the amount of said depositing material passing through said selective shield/material flow assembly and the distribution of said depositing material on said at least one work piece.

19. The apparatus according to Claim 18, further comprising a control connected to said selective shield/material flow assembly for adjusting the size of said at least one adjustable opening of said selective shield/material flow assembly.

20. The apparatus according to Claim 19 wherein said at least one adjustable opening of said selective shield/material flow assembly is a multitude of openings having adjustable sizes.

21. The apparatus according to Claim 20 wherein said multitude of openings having adjustable sizes are formed by pivoting flaps.

22. The apparatus according to Claim 1, wherein said selective shield/material flow assembly includes:

a first selective shield/material flow mechanism forming at least one first opening,

a second selective shield/material flow mechanism forming at least one second opening, wherein

said first selective shield/material flow mechanism and said second selective shield/material flow mechanism are capable of movement relative to each other.

23. The apparatus of Claim 22 wherein said movement relative to each other is rotational movement.

24. The apparatus of Claim 23 wherein said rotational movement is axial rotation.

25. The apparatus of Claim 23 wherein said rotational movement is planar rotation.

26. Apparatus according to Claim 22 further including means connecting said first selective shield/material flow mechanism and said second selective shield/material flow mechanism together for movement relative to each other, wherein said first selective shield/material flow mechanism and said second selective shield/material flow mechanism are moved relative to each other to change the sizes and locations of said at least one first opening and said at least one second opening.

27. Apparatus according to Claim 22, wherein said first selective shield/material flow mechanism includes a first

support member, and a first set of slats supported by said first support member, and positioned so as to form said at least one first opening; and,

said second selective shield/material flow mechanism includes a second support member, and a second set of slats supported by said second support member, and positioned so as to form said at least one second opening.

28. Apparatus according to Claim 26, wherein said means connecting said first selective shield/material mechanism and said second selective shield/material flow mechanism together include a series of links connecting said first and said second support members together for limited transverse movement relative to each other.

29. Apparatus according to Claim 18 further comprising a structure supporting said selective shield/material flow assembly for movement along three mutually orthogonal axes, relative to both said source of depositing material and said work piece holder.

30. The apparatus of Claim 18 wherein said source of depositing material is an anode, said work piece holder is a cathode, and said transport medium is an electroplating solution, wherein said anode and said cathode are immersed in said electroplating solution for generating an electric field emanating from said anode towards said cathode, to

generate a corresponding current to deposit an electroplating material on said work piece during electroplating.

31. The apparatus of Claim 30, wherein said a selective shield/material flow assembly selectively and controllably adjusts the amount of electric flux passing through said selective shield/material flow assembly.

32. The apparatus of Claim 18, wherein said source of depositing material is chosen from the group consisting of spurgers, nozzles, orifices, and atomizers.

33. The apparatus of Claim 18 wherein said source of depositing material comprises metal ions.

34. The apparatus of Claim 33 wherein said metal ions are selected from the group consisting of gold, copper, silver, tin, lead, nickel, chromium, iron, aluminum, and cobalt.

35. The apparatus of Claim 33 wherein said transport solution medium is an electroless plating solution.

36. The apparatus of Claim 18 wherein said transport medium is selected from the group consisting of air, plating solution, solid material suspension, gases, electric fields and magnetic fields.

37. A method of plating a work piece comprising the steps of:

providing a source of depositing material;

providing a transport medium;

providing at least one work piece in a work piece holder;

supporting said at least one work piece in said work holder;

immersing said work piece holder in said transport medium;

positioning a selective shield/material flow assembly between said work piece holder and said source of depositing material in said transport medium, said selective shield/material flow assembly forming at least one opening having an adjustable size; and

adjusting the said adjustable size of said at least one adjustable opening for selectively and controllably adjusting the amount of said depositing material passing through said selective shield/material flow apparatus and the distribution of said depositing material on said at least one work piece.

38. The method according to Claim 37 wherein said selective shield/material flow assembly further includes a first selective shield/material flow mechanism and a second selective shield/material flow mechanism, and the adjusting step includes the step of moving said first shield/material flow mechanism and said second shield/material flow mechanism relative to each other to adjust the said adjustable size of said at least one opening of said selective shield/material flow assembly.